Module #2 Test

1. The Bohr model created the principal quantum number, n

2. The quantum numbe l determines the orbital shape

3. b.

4. The electron might emit 3 different possible wavelengths

5. It is atomic absorbtion spectroscopy

6. electron C is the furthest from the nucleus

7. $\Delta E = (2.18\times10^{-18})Z^2\left(\left(\frac{1}{n_i}\right)^2 - \left(\frac{1}{n_f}\right)^2\right)$

$\Delta E = (2.18\times10^{-18})1^2\left(\left(\frac{1}{2}\right)^2 - \left(\frac{1}{4}\right)^2\right)$

$\Delta E = (2.18\times10^{-18})1\left(\frac{1}{4}\right) - \left(\frac{1}{16}\right)$

$\Delta E = (2.18\times10^{-18})\left(\frac{3}{16}\right) = 4.09\times10^{-19}\,J$

20/21

95%

8. He^+ : $Z^{(2)}$ $E = hf$ $f = \frac{v}{\lambda}$ $h = 6.63\times10^{-34}\,J/s$ $v: 3.00\times10^8\,m/s$

$\Delta E = (2.18\times10^{-18})Z^2\left(\left(\frac{1}{n_i}\right)^2 - \left(\frac{1}{n_f}\right)^2\right)$

$\Delta E = (2.18\times10^{-18})2^2\left(\left(\frac{1}{4}\right)^2 - \left(\frac{1}{2}\right)^2\right)$

$\Delta E = (2.18\times10^{-18})4\left(-\frac{3}{16}\right) = -1.64\times10^{-18}\,J$

$E = 6.63\times10^{-34}(F)$

$\frac{1.64\times10^{-18}}{6.63\times10^{-34}} = \frac{\cancel{6.63\times10^{-34}}F}{\cancel{6.63\times10^{-34}}}$

$F = 2.47\times10^{15}\,Hz$

or $2.47\times10^{15}\,\frac{1}{sec}$

$f = \frac{v}{\lambda}$ $2.47\times10^{15}\,\frac{1}{sec} = \frac{3.00\times10^8\,m/sec}{\lambda}$

$\frac{\lambda \cdot 2.47\times10^{15}}{2.47\times10^{15}} = \frac{\frac{3.00\times10^8}{\lambda}\cdot\lambda}{2.47\times10^{15}}$

$\lambda = 1.21\times10^{-7}\,m$

9. $\Delta E = (2.18\times10^{-18} J) z^2 \left(\left(\frac{1}{n_i}\right)^2 - \left(\frac{1}{n_f}\right)^2 \right)$

$\frac{-4.09\times10^{-19} J}{2.18\times10^{-18} J} = \frac{(2.18\times10^{-18} J) 1 \left(\left(\frac{1}{4}\right)^2 - \left(\frac{1}{n_f}\right)^2 \right)}{2.18\times10^{-18} J}$

$= -0.188 = \frac{1}{16} - \left(\frac{1}{n_f}\right)^2$

$-\frac{1}{16} \qquad -\frac{1}{16}$

$\sqrt{+0.250} = \sqrt{+\left(\frac{1}{n_f}\right)^2}$

$n_f \frac{1}{n_f} = 0.500 \cdot n_f$

$\frac{1}{0.500} = \frac{0.500 n_f}{0.500} \longrightarrow n_f = 2$

10. Li^{2+}; 1 electron $\qquad n = ? \qquad r = ?$

$E = -R_H z^2 \left(\frac{1}{n}\right)^2$

$-4.91\times10^{-18} J = -2.18\times10^{-18} J (3^2) \left(\frac{1}{n}\right)^2$

$\frac{-4.91\times10^{-18} J}{-1.96\times10^{-17}} = \frac{\cancel{-1.96\times10^{-17}} \left(\frac{1}{n}\right)^2}{\cancel{-1.96\times10^{-17}}}$

$\sqrt{0.250} = \sqrt{\left(\frac{1}{n}\right)^2}$

$\frac{1}{n} = 0.500$

$n = 2$

$r = 0.529 Å \left(\frac{n^2}{Z}\right)$

$r = 0.529 Å \left(\frac{2^2}{3}\right)$

$= 0.529 Å \left(\frac{4}{2}\right) = 0.705 Å$

11. Cl : $1s^2 2s^2 2p^6 \underbrace{3s^2 3p^5}_{VE}$

Electron 1 3s : $n=3, l=0, ml=0, ms=\frac{1}{2}$

Electron 2 3s: $n=3, l=0, ml=0, ms=-\frac{1}{2}$

E 3 3p : $n=3, l=1, ml=-1, ms=\frac{1}{2}$

E 4 3p : $n=3, l=1, ml=-1, ms=-\frac{1}{2}$ $-\frac{1}{3}$

E 5 3p : $n=3, l=1, ml=0, ms=\frac{1}{2}$

E 6 3p : $n=3, l=1, ml=0, ms=-\frac{1}{2}$

E 7 3p : $n=3, l=1, ml=1, ms=\frac{1}{2}$ $-\frac{1}{3}$

~~$1s^2$~~
~~$2s^2 2p^6$~~
~~$3s^2 3p^6 3d^{10}$~~
~~$4s^2 4p^6 4d^{10}$~~
~~$5s^2 5p^6 5d^{10}$~~
~~$6s^2 6p^6 6d^{10}$~~

s p d f
0 1 2 3

7 electrons $+\frac{2}{3}$

$\frac{+6}{7}$

12. a) ml must be 0 $-l < m_l < l$ OK when $n=2$

b) ms can only be $\frac{1}{2}$ or $-\frac{1}{2}$

c) when $n=2$, l can only be 0 or 1